

Enhancing Cardiac Diagnosis and Treatment Capability with Automation and Laboratorian/Clinician Collaborations

Primary Presenter Denise L. Uettwiller-Geiger, Ph.D., DLM (ASCP) · Administrative Director and Clinical Chemist for the Clinical Laboratories
 John T. Mather Memorial Hospital (JTMMH) · Port Jefferson, N.Y.

Other presenters Peter Bruno, M.D. · Section Chief of Cardiology – JTMMH · Owen Yen, M.D. · Cardiologist – JTMMH

Joan Faro, M.D. FACP, M.B.A. · Vice President for Clinical Affairs – JTMMH · Judith Mignone, B.S. · Associate Administrative Director for the Clinical Laboratories – JTMMH

Summary

Administrators for the clinical laboratory of a 248-bed community hospital attempted to improve clinical outcomes for chest pain patients by: 1) Implementing laboratory automation and advanced assays; 2) Promoting information exchange and collaboration between laboratorians and physicians; 3) Developing tools that support physicians in optimally utilizing lab services.



Clinical gains included faster, more predictable turnaround time (TAT) for test results, including for the key cardiac marker, troponin I; smoother adaptation by physicians to newly implemented assays; and faster, better-informed decisionmaking by physicians, leading to improved patient care.

Facility

John T. Mather Memorial Hospital (JTMMH) is a 248-bed community hospital located in Port Jefferson, NY. In 1998, it opened the Cody Ambulatory and Inpatient Surgical Pavilion, a state-of-the-art, 65,000-square-foot surgical center designed to meet the growing demand for outpatient procedures. JTMMH also featured the first chest pain emergency room and hyperbaric oxygen therapy unit on Long Island, as well as Long Island's first successful in vitro fertilization program. Additionally, the hospital opened the first wound care center and autologous stem cell/bone marrow transplant program in Suffolk County, and offered the first inpatient adolescent psychiatric unit and psychiatric partial hospitalization program in a Suffolk County community hospital.

Challenge

Physicians need fast, accurate test results if they're to make timely, appropriate treatment decisions for chest pain patients and save heart muscle. Yet time pressures and the sheer quantity of information to manage also make it difficult for physicians to remember every cardiac test protocol/attribute. This is particularly true as the cardiac field evolves and new, more effective tests and protocols emerge.

Objective

Address the challenge from several different angles:

- Optimize technological advantages by installing laboratory automation and implementing state-of-the-art cardiac assays.
- Optimize physicians' learning curve for utilizing the new assays – and other information provided by the lab – by developing forums that promote information exchange and collaboration between laboratorians and physicians.
- Give additional support to physicians by providing hard-copy information about the new assays and other tests.
- Support clinicians in making rapid, appropriate decisions regarding test ordering, test interpretation and treatment, by developing decisionmaking tools that are consistent with cardiac best practices.

Interventions

1) Laboratory automation.

- Pre-analytic phase of testing.** A Power Processor automation system with decapper and centrifugation performs sample log-in, centrifugation and sorts samples for the appropriate analyzer.
- Analytic phase.** Two SYNCHRON LX20 chemistry analyzers (connected to automation line), one Access 2 Immunoassay System (not on automation line), and user-defined outlet (for Access 2).
- Post-analytic phase.** 3,020-tube refrigerated stockyard (connected to automation line) allows automated retrieval for repeat or add-on testing.
- Tracking.** Connects Power Processor, LX20s and stockyard.

- Autovalidation of normal results.** Automated analyzers, in conjunction with the laboratory information system (LIS), validate normal results – according to user-defined criteria – and report the results directly to the LIS. At JTMMH, about 75-80 percent of results are autovalidated, a major factor in improved TAT.
- Single vendor solution.** All automation hardware/software and instruments were provided by Beckman Coulter (Fullerton, CA).

2) Advanced cardiac assays

- Access AccuTnl (Beckman Coulter).** This assay for troponin I was adopted as the cornerstone marker for cardiac necrosis. It replaced myoglobin and CK-MB, which are less sensitive and specific for cardiac damage. AccuTnl meets or exceeds certain performance standards recommended by the European Society of Cardiology (ESC)/American College of Cardiology (ACC) joint committee. AccuTnl speeds diagnosis and treatment because its time-to-result is only 12 minutes. Its superb sensitivity is also useful in stratifying patients who have "intermediate zone" levels of troponin (i.e., levels that are below the myocardial infarction cutoff, but above the 99 percent upper reference level). Patients at the higher end of this range may be at significant risk of future heart injury and death, and could benefit from aggressive treatment.
- IMA (Ischemia Technologies – Denver, CO).** This assay for ischemia-modified albumin is useful for chest pain patients who present with non-ST elevation. A highly sensitive cardiac marker, IMA is considered an important diagnostic advance for detecting a reduction in blood flow and an early heart attack, particularly when combined with an ECG and a sensitive marker such as troponin. IMA also has a high negative predictive value, making it a useful marker of myocardial ischemia when combined with other markers.

3) Forums for information exchange and collaboration between laboratorians and physicians

- Heart team.** A clinician/laboratorian "heart team" – including laboratorians, physicians, nurses, physical therapists, nutritionists, nuclear medicine experts and others – was formed to discuss and implement best practices in cardiac care.



Left, Drs. Mitchell Pollack, Peter Bruno, Owen Yen, Denise Uettwiller-Geiger and Joan Faro.

- Formal meetings.** Laboratorians attend meetings involving cardiologists – including critical care meetings and medical department meetings – to increase opportunities for information exchange.
- Informal exchanges.** Laboratorians take advantage of informal opportunities for communications with physicians such as grand rounds, drop-in visits, phone conversations, and other casual encounters.

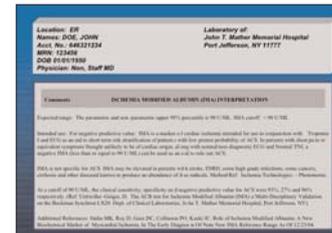


4) Tools to support clinicians in test ordering/interpretation and treatment.

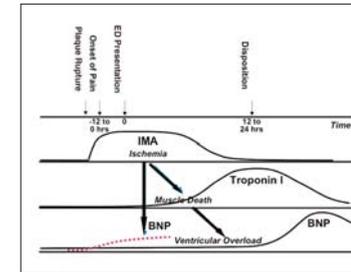
- Check-off protocols, algorithms, and check-off test order sets.** An initial "Chest Pain ER Sheet" provides protocols – one for non-ST elevation and one for ST elevation – that help physicians decide which tests to order and when to order them, based on lab results and the patient's clinical presentation. The sheets are also designed to assist physicians in ordering tests quickly without having to recall all possible tests that should be included, and to stratify patients for possible aggressive treatment. Depending upon the options selected by the physicians, the use of other lab-created algorithms and check-off test order sets are triggered.



- Expanded lab reports (called "Smart Reports" at JTMMH).** These detailed reports include a description of the marker if the marker is new to the lab, intended use of the test, expected reference range, clinical sensitivity and specificity, potential interferences, negative and positive predicative value, suggested follow-up tests and references. Physicians at JTMMH often carry these reports with them so they always have the information at hand.

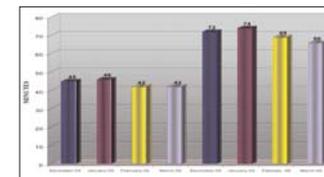


- Other informational tools.** Anticipating physicians' needs, the lab generates other tools to support doctors in test ordering/interpretation and treatment, including sheets that explain the advantages and disadvantages of different tests and newsletters that update physicians on the introduction of new tests, cover test-related issues that require clarification, and standardize test-related information for physicians.

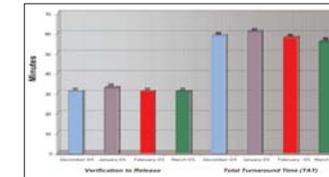


Results

- TAT for troponin I.** Post-automation, TAT is now 42 minutes from verification to release to ED, 37 minutes less than pre-automation. The lab processes roughly 26,000 Tnl tests per year, magnifying impact of minutes saved.



- TAT for basic metabolic panel (BMP).** Since the lab automated, TAT has dropped to roughly < 33 minutes min. from time of receipt in the laboratory to delivery of result to the physician. This compares to 71 min. in April 2001, when lab staff was inexperienced with using the automated lab equipment and autovalidation had yet to be implemented.



- More predictable TAT.** Automation creates more predictable TAT, leading to better use of clinicians' time (physicians rarely call the lab about delayed results).
- More reliable results and results reporting.** Automation creates more reliable results and results reporting by virtually eliminating testing errors. For example, barcode technology eliminates mismatches between specimen and patient.
- Faster, better-informed diagnosis/treatment.** Lab reports provide context and insight – including initial interpretation of results – along with test results. This helps create more timely diagnosis and treatment and improved patient care.

- Reduced patient stays in the ED.** Faster, more predictable TAT, new cardiac assays, and the lab's contribution to test interpretation have helped reduce patient length-of-stay in the hospital's emergency department (ED), while also reducing unnecessary admissions. Population growth and an aging population in JTMMH's service area have increased demand for ED and associated services: ED visits have increased roughly 100 percent since 1996 – in 2004, JTMMH had more than 42,000 ED visits, with chest pain and assessment-of-acute-coronary-syndrome patients comprising roughly one quarter of that total. The added demand would be difficult for the hospital to manage without the improved TAT provided by lab automation; the faster and more accurate diagnoses afforded by the new cardiac assays; and the assistance the lab has

provided to physicians for interpreting test results, including the results of the new assays. The quality of the information provided by the lab and the speed with which it is delivered help physicians make quick decisions about the disposition of patients on hand, which clears space for new patients.

- Increased value of the lab.** The above initiatives and results demonstrate that the value the lab can contribute to patient care goes well beyond improved quality and timeliness of testing.

Conclusions

- Lab automation is essential to the service level clinicians require. Automation makes it possible to dramatically reduce TAT, while delivering accurate results.
- The lab directly contributes to improved cardiac care by implementing advanced markers and protocols, rather than continuing to use outmoded testing modalities.
- Laboratorian/clinician communication forums and collaborations enable labs to introduce advanced assays effectively, enhance clinicians' understanding of test results, and support clinicians in implementing cardiac best practices. These information exchanges also give laboratorians insights into test results from a clinician's perspective – for example, how a result should be interpreted in light of the patient's clinical presentation and results from his/her ECG, stress testing, and catheterization.
- The overall results of the presenters' experience suggest that by taking the initiative, labs can play a broader role in improving cardiac care than is traditional for the clinical laboratory.

